MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
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SRM Number: 2717a
MSDS Number: 2717a
SRM Name: Sulfur in Residual Fuel Oil
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Sulfur in Residual Fuel Oil

Description: A high viscosity residual oil. A mixture of petroleum hydrocarbons (paraffinic, olefinic, naphthenic, and aromatic). A fuel oil of high sulfur content.

Other Designations: Sulfur (brimstone, sulphur) in Fuel Oil No. 6.

Name	Chemical Formula	CAS Registry Number
Sulfur in Residual Fuel Oil	complex mixture	68553-00-4

DOT Classification: Not regulated by DOT.

Manufacturer/Supplier: Available from a number of suppliers.

NOTE: This material contains a nominal sulfur concentration of 3 % and may release hydrogen sulfide.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Component	Nominal Concentration	Exposure Limits and Toxicity Data
Residual Fuel Oil No. 6	~ 99	OSHA TLV-TWA: 5 mg/m^3 (mineral oil mist)
		OSHA TLV-TWA: 0.2 mg/m^3 (coal tar pitch volatiles)
		OSHA Ceiling: 20 mg/kg (hydrogen sulfide)
		Rat, Oral: LD_{50}: 5.1 g/kg
		Rabbit, Skin LD_{50}: >5 mL/kg
		Rabbit, Eye Irritation: 100 µL (mild)
		Rabbit, Skin Irritation: 500 mg

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Residual Fuel Oil No. 6	
Appearance and Odor: a black liquid to heavy paste with a petroleum odor	**Kinematic Viscosity (@ 40 °C):** 540.2×10^{-6} m^2/s (540.2 cSt)*****
Density (@ 15 °C): 991.2 kg/m^3*	**Kinematic Viscosity (@ 50 °C):** 282.0×10^{-6} m^2/s (282.0 cSt)*****
Density (@ 60 °F): 11.2 API	**Kinematic Viscosity (@ 100 °C):** 31.7×10^{-6} m^2/s (31.7 cSt)*****
Boiling Point: not available	**Heat of Combustion:** 42.27 MJ/kg (18 171 Btu/lb)*****
Pour Point: -11.6 °C*****	**Water Solubility:** not available

***** Values obtained from physical tests and measurements of SRM 2717a using ASTM methods.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: 73 °C* **Method Used:** PMCC **Autoignition Temperature:** 407.22 °C

Flammability Limits in Air (Volume %): **UPPER:** 20.1
LOWER: 3.9

Extinguishing Media: Use a dry chemical powder, carbon dioxide, or foam. Use a water spray to cool fire exposed containers only. **DO NOT** use a forced water stream directly into an oil fire as this will only scatter the fire; use a smothering technique for extinguishing the fire of this combustible material.

Unusual Fire and Explosion Hazards: Heating this material greatly increases the fire hazard. Hydrogen sulfide may be released when heated. Thermal oxidative degradation may also yield hazardous gases, such as oxides of sulfur and carbon.

Special Fire Procedures: Fuel Oil No. 6 is an OSHA Class IIIA combustible liquid. Firefighters should wear self-contained breathing apparatus and full protective clothing.

***** Value obtained from physical tests and measurements of SRM 2717a using ASTM methods.

SECTION V. REACTIVITY DATA

Stability: **_X_ Stable** **____ Unstable**

Conditions to Avoid: Avoid heat, flames, and sources of ignition. Containers may rupture or explode if exposed to heat. Dangerous gases may accumulate in confined spaces.

Incompatibility (Materials to Avoid): This material is a fire and explosion hazard when exposed to strong oxidizing agents.

Hazardous Decomposition or Byproducts: Hydrogen sulfide may be released when heated. Thermal decomposition may also produce oxides of sulfide and carbon. See Section IV: *Fire and Explosion Hazard Data.*

Hazardous Polymerization: **_____ Will Occur** **_X_ Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: **X** **Inhalation** **X** **Skin** **X** **Ingestion**

Effects of Overexposure (ACUTE):

Eyes: May cause minimal irritation, experienced as temporary discomfort.

Skin: Prolonged or widespread skin contact may result in the absorption of potentially harmful amounts of material. Brief contact may cause slight irritation. Prolonged contact, as with clothing wetted with material, may cause more severe irritation and discomfort, seen as local redness and swelling.

Inhalation: The inhalation hazard is low unless heated or misted. Contains or may release hydrogen sulfide (H_2S) gas. H_2S concentrations above permissible concentrations can cause headache, dizziness, nausea, vomiting, and diarrhea. At concentrations above 300 ppm, respiratory paralysis, causing unconsciousness and death, can occur.

Ingestion: If more than several mouthfuls are swallowed, abdominal discomfort, nausea, and diarrhea may occur.

Medical Conditions Generally Aggravated by Exposure: Acne and dermatitis.

Listed as a Carcinogen/Potential Carcinogen:*

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens		X
In the International Agency for Research on Cancer (IARC) Monographs	X*	
By the Occupational Safety and Health Administration (OSHA)		X

*The IARC lists residual (heavy) fuel oils as Group 2B: possibly carcinogenic to humans.

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Wipe excess oil off with a dry cloth. Wash affected area well with soap and large amounts of water. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 min. Obtain medical assistance.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. Obtain medical assistance immediately.

TARGET ORGAN(S) OF ATTACK: The skin, eyes, and upper respiratory tract.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material Is Released: Notify safety personnel of leaks and spills. Remove sources of heat or ignition and provide adequate ventilation. Personnel performing the clean-up should use protection against contact with the liquid and vapor or mist inhalation. Small spills can be contained by absorbents, such as rags, straw, polyurethane foam, activated carbon, and sand. Clean up spills promptly to reduce fire or vapor hazards. Large oil spills must be reported to the authorities.

Waste Disposal: The material may be disposed of by a licensed waste disposal company, by controlled incineration or burial in an approved landfill. Follow all federal, state and local authorities.

Handling and Storage: Provide adequate ventilation where operating conditions (heating and spraying) may create excessive vapors and mists. Use explosion proof equipment. Provide approved respiratory apparatus for non-routine or emergency use. Use

an approved filter and vapor respirator when vapor or mist concentrations are high. Wear protective rubber gloves and chemical safety glasses where contact with the liquid or high vapor concentrations may occur. Additional suitable protective clothing may be required depending on working conditions. An eye wash station and washing facilities should be readily available near handling and use areas. Wash exposed skin areas thoroughly after handling this material. Do not smoke in areas of use.

> **NOTE:** Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store material in closed containers in a cool, dry, well ventilated area away from sources of heat, sparks, open flames, and oxidizing agents. Protect containers from physical damage.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Fuel Oil No. 6*, September 16, 1999.
Texaco, MSDS 03035 Intermediate Marine Fuel IF-380, July 15, 1992.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data on the MSDS. The certified value for this material is given on the NIST Certificate of Analysis.